1886MNRAS..46..282M

Note on some recently published Spectroscopic Observations.

By E. W. Maunder.

There have been published recently three series of spectroscopic observations to which I should like to draw the special attention of the Society, as each in its own department is of considerable novelty and importance, and it seems to me that it is, on that account, very desirable that they should not take their place among the accepted facts of science without a thorough and searching criticism. It may seem ungracious thus to challenge definite and positive observations; but I need scarcely say that I have not the smallest idea of calling in question the good faith of the observers. My only wish is to draw such attention to the observations referred to as may result in the publication of further details respecting them, or in inducing other observers to make such further researches in the same directions as may confirm or discredit those before us. I am aware that it is not very usual for papers read before the Society to be of a merely critical character; but if the present Note should lead to the bringing out of further and more decisive results, I do not think it will have been useless.

I. Bright Lines in Stellar Spectra. Mr. O. T. Sherman. *Science*, vol. vi., pp. 262, 336, and 386; *Amer. Jour. of Science*, vol. xxx. pp. 378 and 475; *Astronomische Nachrichten*, Nos. 2707 and 2709.

The first series of observations to which I would ask attention is the detection of bright lines in stellar spectra, by Mr. O. T. Sherman, of Yale College Observatory. The first published observation by Mr. Sherman appeared in the number of *Science* for September 18, 1885, and described the detection of certain bright lines in the spectrum of *Nova Andromedæ*. A second communication furnished the positions of these lines, and I was naturally much gratified to find that Mr. Sherman's determinations agreed with the rough estimations I myself had made, in a manner which was really remarkable when the difficulty of the observation was borne in mind. Mr. Sherman has since examined the spectra of many other stars, beginning with β *Lyræ* and γ *Cassiopeiæ*. In these two he found not only the bright lines of hydrogen usually seen, but a number of other bright lines, corresponding apparently to the principal lines of the solar chromosphere. In all seventeen bright lines were detected in the spectrum of β *Lyræ*.

So far, though Mr. Sherman's results were both interesting and striking, there was nothing on the surface to provoke scepticism. The two stars in question are known to have certain bright lines in their spectra, and it might well be that an observer might detect fresh ones, either by the aid of a special equipment, or by means of an exceptionally keen sight. But Mr. Sherman

1886MNRAS..46..282M

has since examined the spectra of some fifty other stars, and his report upon them is that "in *each* case many or few bright lines have been seen." It is clear that if this statement can be substantiated, we have here an advance in stellar spectroscopy of the most important character. The question naturally arises as to what was the instrumental means at the observer's command?

The telescope employed had an aperture of 8 inches; the spectroscope was a direct-vision one, with two sets of prisms, three in each set. With one set of prisms b_3 and b_4 are barely separated; with both sets the nickel line between D_1 and D_2 is seen. The collimator is about six inches long, and "the power of the eyepiece of the observing telescope is about 130," meaning, I suppose, the power which the eyepiece would have if used on the Equatorial telescope of 8-inch aperture, and not the power it would have when taken in conjunction with the viewing telescope of the spectroscope alone.

So far there seems little ground for criticism; the instrument, if not specially powerful, would seem fairly suited to the work; but there seem some points in Mr. Sherman's further account of his method which, if I rightly interpret them, indicate, I would venture to think, a faulty procedure.

First: "previous to each night's work the instrument was adjusted upon the Sun; a solar spot, when possible, being brought sharply in focus upon the jaws of the slit." This would seem a proper and necessary adjustment, and would suffice for the centre of the spectrum; but for the extreme rays, especially the blue and violet, the spectroscope would not be in the proper focus of the equatorial. There is a paragraph in Mr. Sherman's paper which at least suggests that the extreme ends of the spectrum suffered from maladjustment in this way: "At the red end under a sharp focus they" (the bright lines) "stand out the full breadth of the spectrum, bearing somewhat the same relation to the background as the prominence to the solar spectrum. In the brighter portion of the spectrum they are cut down to fine star-points. At the blue end they become more distinct, but not so sharp as at the red. At times they shine with almost a metallic brilliancy; at other times they are faint, faded, and easily passed over. Certain sets appear to be prominent at times, others at other times."

It seems very difficult to believe that this can be a description of the behaviour of true stellar bright lines, while it is quite conceivable that lines due to some instrumental defect might present just such an appearance in a spectroscope adjusted, as Mr. Sherman's seems to have been, only for the centre of the spectrum, particularly as he placed his cylindrical lens, not before the slit, nor even in the viewing telescope, but between the eyepiece and his eye.

Secondly: Mr. Sherman used an unusually wide slit, "5^{mm} or more." I think most stellar spectroscopists will pronounce

1886MNRAS..46..282M

this to have been fully 100 times too wide. 5^{mm} in the focus of the 8-inch object-glass would correspond to 6′ of arc. It seems hard to see what purpose a slit of so great a width would serve, and in what essential feature it differed from no slit at all. And it is also difficult to place much confidence in measures made with so wide a slit, especially as the collimator only measured 6 inches in focal length, so that no stress can be laid upon the correspondence between the bright lines observed, and those seen in the solar chromosphere.

The most suspicious circumstance of all, however, is, I think, that so far Mr. Sherman has never failed to see bright lines in any star which he has examined; and that though "sometimes they shine with almost a metallic brilliancy," yet no previous observer has ever detected them.

My experience of bright lines in stellar spectra has been limited to γ *Cassiopeiæ*, and perhaps *Nova Andromedæ*. But I have had occasion to notice on more than one occasion that a stellar spectrum which is full of dark lines or bands may, when badly seen, give a very perfect illusion of bright lines; the dark lines escaping recognition as such, but producing their effect by making the parts of the spectrum most free from them shine out by contrast like a veritable chromospheric spectrum. I have also, in my measures of the displacement of lines in stellar spectra, used on some 100 stars a dispersion considerably greater than Mr. Sherman's, the very greatest, in fact, the star would bear, without bringing up the faintest trace of a bright line; so that I cannot put down my own failure to detect these lines to insufficient dispersive power.

Since I commenced to draw up this note, Prof. Vogel has criticised* Mr. Sherman's observations in the *Astronomische Nachrichten*, on grounds which closely correspond to some of those which I have here brought forward; but he mentions in addition the mistake which Secchi fell into with regard to the spectrum of *Sirius*: an instance which shows how readily even an experienced spectroscopist may be made the victim of an instrumental illusion.

II. Observations of the Spectrum of *Nova Orionis*. Dr. Ralph Copeland. *Monthly Notices*, vol. xlvi. No. 3.

In venturing to criticise Dr. Copeland's paper on the spectrum of the new star near χ_1 *Orionis* read before this Society at the January meeting, I have not the smallest intention of calling in question the observations themselves. These are undoubtedly very accurate; the only point open to question is the interpretation to be put upon them. There is no doubt as to the general appearance of the spectrum. It resembles the spectra of Secchi's third type, of which α *Orionis*, α *Herculis*, *Mira Ceti*, and β *Pegasi* are amongst the best known examples. But the contrasts of

---

* *Astron. Nachr.* No. 2712.